University of Alberta

Contemporary Textiles Using Cloqué

by

Sheila Ann Gillen ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of MASTER OF ARTS.

in

Textiles and Clothing

Department of Human Ecology

Edmonton, Alberta

Fall, 2000

National Library of Canada
Acquisitions and Bibliographic Services
395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale du Canada
Acquisitions et services bibliographiques
395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-59719-9

Canada

University of Alberta

Library Release Form

NAME OF AUTHOR: Sheila Ann Gillen

TITLE OF THESIS: Contemporary Textiles Using Cloqué

DEGREE: Master of Arts

YEAR THIS DEGREE GRANTED: 2000

Permission is hereby granted to the University of Alberta Library to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly, or scientific research purposes only.

The author reserves all other publication and other rights in association with the copyright in the thesis, and except as hereinbefore provided, neither the thesis nor any substantial portion thereof may be printed or otherwise reproduced in any material form whatever without the author's prior written permission.

Sheila Gillen

August 24, 2000

1403 - 10101 Saskatchewan Drive
Edmonton, Alberta, T6E 4R6
CANADA

ABSTRACT

The purpose of this study was to examine cloqué which is a textile finishing technique and to determine its uses for textile artists concerned with the creation of contemporary textiles. Documentation of the design process took the form of a journal/sketchbook, a lab notebook, photographs, and computer manipulation. Adobe® Photoshop® 5.5 computer software was used to manipulate the photographic images. Inspiration for the textiles was derived from the designer's photographs of Edmonton landscapes.

Five projects were completed. Each project utilized silk and cheesecloth with a polyester backing along with cloqué processes. Projects 1, 2, and 3 consisted of two textiles each and were inspired by cloudy skies, bushes, and trees, respectively. Project 4 consisted of four textiles inspired by a morning sky, and Project 5 consisted of six textiles inspired by the evening sky.

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **CONTEMPORARY TEXTILES USING CLOQUE** submitted by **SHEILA ANN GILLEN** in partial fulfillment of the requirements for the degree of **MASTER OF ARTS** in **TEXTILES AND CLOTHING.**

Dr. Marlene Cox-Bishop

Dr. Nancy Kerr

Dr. Donald Kuiken

DATE: Aug. 23, 2000

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my supervisor, Dr. Marlene Cox-Bishop, for her guidance and great patience throughout my graduate study. I would also like to thank my committee members, Dr. Nancy Kerr and Dr. Donald Kuiken, for their helpful questions and comments. I wish to acknowledge the Department of Human Ecology for their kindness and consideration.

A special thank you to my mother, Rose Gillen, for her encouragement and support, and to my grandfather, G. Hilsenteger, my sister Marlene, and friends.

TABLE OF CONTENTS

CHAPTER		PAGE
1.	INTRODUCTION	1
2.	LITERATURE REVIEW	
•	Definition of Terms	3
•	Literature Related to Mercerization	6
	History of Mercerization	6
	Materials of Mercerization	7
	Processes of Mercerization	7
	Applications of Mercerization	12
•	Literature Related to Cloqué	12
	History of Cloqué	12
	Materials of Cloqué	13
	Processes of Cloqué	13
	Applications of Cloqué	20
	Summary	24
3.	THE DESIGNING PROCESS	
•	Statement of the Problem	28
•	Purpose and Objectives	28
•	Significance of the Study	29
•	Limitations and Delimination	29
4.	PRELIMINARY DESIGN STUDIES	
•	Imagery	31
•	Computer-Aided Designing Using Adobe® Photoshop® 5.5	33
•	Dyes and Fabrics	33
•	Exploration of Cloqué Processes	34
•	Preparation of the Cloqué Samples	36
•	Results of Cloqué Samples	39
•	Determination of Optimum Concentration of NaOH	40
•	Preparation of the Dyed Cloqué Samples	40
•	Results of Dyed Cloqué Samples	42
5.	CREATION OF THE WORKS OF ART	
•	Creation of the Works of Art	47
•	Project 1 - Cloud Sky	48
•	Project 2 - Bushes	53

- Project 3 - Trees..... 58
- Project 4 - Morning Sky..... 64
- Project 5 - Evening Sky..... 68
- Summary..... 73

6. **CONCLUSIONS AND NEW DIRECTIONS**..... 74

7. **BIBLIOGRAPHY**..... 78

8. **APPENDIX**

- Appendix A..... 81
- Appendix B..... 82
- Appendix C..... 86
- Appendix D..... 87

LIST OF FIGURES

PAGE

1. Scaffolding systems..... 5
2. Mercerized and unmercerized cotton fibres..... 10
3. Stages of cotton swelling in mercerization 11
4. Construction of preliminary samples..... 37
5. Stitching patterns on preliminary samples..... 37
6. Zeisel's spiral model of the design process..... 75

LIST OF PLATES

PAGE

1. Striped plissé fabric 15
2. Copper Traces by J. Bissell 16
3. Minoan Casement by J. Bissell 17
4. Valentine Coat by J. Bissell 18
5. Tension Game by J. Bissell 19
6. Forgiveness by S. L. Marker 22
7. Devoré and Cloqué fabrics by Ana Lisa Hedstrom 23
8. Crêpe-treated silk and cotton artwork by Thea Bjerg 24
9. Crêpe-treated silk satin artwork by Thea Bjerg 25
10. Sculpture with lye crimping by Mette Viereck 27
11. View of the evening sky, Edmonton, Alberta 32
12. View of trees, Edmonton, Alberta 32
13. Sample, 15cm x 15cm 37
14. Sample 1, painted on dry silk, after stitching 43
15. Sample 1, after shrinking 43
16. Sample 2, painted on wet silk, after stitching 44
17. Sample 2, after shrinking 44
18. Sample 3, wax resist lines, after stitching 45
19. Sample 3, after shrinking 45
20. Sample 4, wax resist lines in a block pattern, after stitching 46
21. Sample 4, after shrinking 46
22. View of cloudy sky, Edmonton, Alberta 49
23. Computer-manipulated image of Plate 22 49
24. Cloudy sky, piece 1, stitched 50
25. Cloudy sky, piece 1, shrunk 50
26. Cloudy sky, piece 2, stitched 51
27. Cloudy sky, piece 2, shrunk 51
28. Cloudy sky 52

LIST OF PLATES

PAGE

29. View of bushes, University of Alberta Campus, Edmonton, Alberta..... 54
30. Computer-manipulated image of Plate 29..... 54
31. Bushes, piece 1, stitched..... 55
32. Bushes, piece 1, shrunk..... 55
33. Bushes, piece 2, stitched..... 56
34. Bushes, piece 2, stitched..... 56
35. Bushes..... 57
36. View 1 of trees, University of Alberta Campus, Edmonton, Alberta..... 59
37. Computer-manipulated image of Plate 36..... 59
38. View 2 of trees, University of Alberta Campus, Edmonton, Alberta..... 60
39. Computer-manipulated image of Plate 38..... 60
40. Trees, piece 1, stitched..... 61
41. Trees, piece 1, shrunk..... 61
42. Trees, piece 2, stitched..... 62
43. Trees, piece 2, shrunk..... 62
44. Trees..... 63
45. View of morning sky, Edmonton, Alberta..... 65
46. Computer-manipulated image of Plate 45..... 65
47. Morning Sky, piece 2, shrunk..... 66
48. Morning Sky, piece 3, shrunk..... 66
49. Morning Sky..... 67
50. View of evening sky, Edmonton, Alberta..... 70
51. Computer-manipulated image of Plate 50..... 70
52. Evening Sky, piece 1, shrunk..... 71
53. Evening Sky, piece 2, shrunk..... 71
54. Evening Sky..... 72
55. Jacquard silk with bamboo..... 77

CHAPTER 1

Introduction

My aim in this study was to document the creative and technical processes I used to explore my impressions of landscapes in the creation of cloqué textiles. Muc (cited in Weir, 1994) states that the perceptions and interpretations of a designer's experience are constantly changing as a result of experiences and memories. MacLeod (cited in Weir, 1994) describes the creative process as being varied, as it is formed by the personality, the experiences, the knowledge and the ideas of the individual.

To begin my study, I considered numerous fabric finishes that create or alter surface texture. Some of these may be created mechanically, as in the napping and sueding of fabric. Some surface finishes that designers make use of are created chemically. Examples are devoré and a type of mercerization known as cloqué or lye crimping.

The process of creating a bubbled surface on fabric through immersion in sodium hydroxide (NaOH) is variously known as plissé, lye crimping, crêpon effect, imitated cloqué, cloqué and crimp. In the field of textile design, it is the term "cloqué" which is most commonly used and, therefore, it is the term I will use in this thesis.

Both cloqué and devoré (or burn-out) are chemical treatments used for designing textiles by textile artists. These finishing techniques have been in general use for about 150 years, mostly as industrial finishing processes. Recently, there has been a revival of interest by both artists and industry in the use of these techniques. This may have been stimulated by a resurgence of public interest in apparel designer applications of cloqué

(Bertolina, 1970; Brierly, Connor, & Provost, 1985; Datye & Vaidya, 1984; Parikh, 1979; Steiger, 1980). Various journal articles on cloqué and on devoré in International Textile Reports, and American Dyestuff Reporter, mention applications for fashion, and recent fashion publications such as Textile Horizons have reported on cloqué and devoré (Czerny, 1988; Parikh, 1979; Perkuhn, 1986; Reed, 1989; "Spring Wool is 'Real Cool,' 1983). There has also been increasing interest in cloqué and devoré as processes which can be used by individual textile artists in their creative explorations (Boutrup & Pollen, 1994; Danielson, 1995; Johnson, 1995; Surface Design 78, 1978). An example of this interest was indicated by Boutrup and Pollen's (1994) lectures and workshops on cloqué and devoré techniques and applications at the Surface Design Association Conference in 1994.

CHAPTER 2

Literature Review

In this chapter, I organised the relevant literature related to cloqué processes into two sections. In the first section, I review the literature related to mercerization relevant to the studio setting: its history, materials, processes, and applications. In the second section, I review the literature related to cloqué: its history, materials, processes and applications. Each of these two main sections is further divided into literature of a textual nature and literature of a visual nature. Literature of a textual nature includes information from sources such as texts, journals, theses, magazines, conference papers, technical bulletins, and abstracts. Literature of a visual nature includes descriptive information from sources such as photographs and drawings or diagrams found in texts, journals and magazines.

Definition of Terms

Chemical water is a chemical mixture used to mix and dilute fibre-reactive H-series liquid dyes. It contains urea which assists the dye in dissolving, penetrating the fabric, and in keeping the fabric damp longer during fixation. A necessary ingredient in chemical water is the sodium salt of nitrobenzene sulfonic acid, which is needed for all dyes used on silk. It is sold under a variety of names, including Resist Salt L, Atexal PA-L, Sitol, Nacan, and most commonly, Ludigol. Chemical water is added to H-series liquid dyes for both thick and thin applications to prevent the dyes from decomposing during the fixation process and to ensure a maximum colour yield. Another ingredient in chemical

water is sodium carbonate, which is used as an alkaline fixative for black fibre-reactive dye. For all other fibre-reactive dye colours, sodium bicarbonate is used as a mild alkali to fix the dye. Sodium hexametaphosphate is a pure water softener added if tap water which contains impurities such as minerals is used to mix the chemical water (See Appendix C).

Cloqué is the name used to describe the crinkled fabric produced by lye crimping or slack mercerization. In slack mercerization, the cotton fabric is left slack during treatment and drying. This produces a fabric with a certain degree of elongation and elasticity. It is also known as 'plissé', 'crêpon effect', 'imitated cloqué' and 'crimp'.

Design Motif is a unit repeated as a thematic element. Geometric motifs are those motifs which are derived from squares, circles, triangles, and other geometric shapes. Naturalistic motifs are realistic depictions of objects, plants, or animals found in the natural environment. Stylised motifs or abstract motifs are depictions of natural shapes, which have been simplified or distorted.

Dispersing Agent is a surface-active substance added to a suspension, usually a colloid, to improve the separation of particles and to prevent settling or clumping.

Fixation is the process by which dyes are made permanent on the fabric. It is accomplished by the application of heat or chemicals or by oxidation in the air after drying (air curing). Any of these processes causes a chemical reaction of the dye with the fibre and this chemical change makes the dye insoluble.

Fixative is a chemical such as sodium carbonate or sodium bicarbonate which is used to fix dyes chemically to the fabric.

Lye Crimping is another name for the cloqué mercerization processes on cotton.

Mercerization is a permanent treatment of cotton fabric or yarns with 10-30% solution of sodium hydroxide, which is a strong alkali. When mercerized under slack tension, the cotton fibres swell and shrink in length and the fabric becomes more dense. This is known as slack mercerization. Another name is lye crimping.

Momme (m/m) is a Japanese unit of weight equal to 3.75 grams, used to describe the weight of silk fabrics. It is expressed as the weight in momme of a degummed piece of silk 22.8 meters long and 3.8 cm wide.

Plissé is a fabric finish and also a fabric name for the crinkled fabric produced by slack mercerization or lye crimping. An example of this fabric is imitation seersucker, which is produced by printing sodium hydroxide in stripes.

Procion Fibre Reactive Dyes are a class of dyes which react chemically with fibre molecules and are suited for use in dyeing protein fibres such as silk and wool, as well as cellulose fibres such as cotton, linen and viscose rayon. These dyes produce bright colours, and have excellent resistance to light, washing, boiling, bleach and crocking (friction). They are available in two ranges: Mx-series and H-series.

Scaffolding Systems are the grids which designers use to organize motifs. The major scaffolding systems are square, brick, half-drop, diamond, ogee, scale, and hexagon.

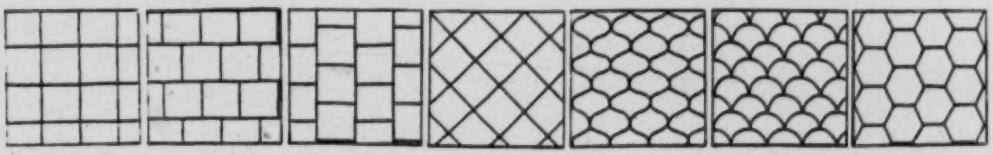


Figure 1. Scaffolding Systems

Slack Mercerization is the mercerization of fabric without it being held under tension at any time.

Sodium Hydroxide (NaOH) is a strong alkali which is also known as caustic soda or lye. In cloqué process, it is used to shrink the cotton fibres.

Wetting Agent is a chemical which increases the speed of the penetration of the finish into the fabric.

Literature Related to Mercerization

Fabric surface finishes serve many purposes, such as creating water repellency, wrinkle resistancy, soil release capabilities, and creating or altering texture. One fabric surface finish is mercerization, which is the permanent treatment of cotton fabric or yarns with 10-30% sodium hydroxide solution. Literature related to mercerization is included in this thesis because it provides a context for the discussion of cloqué which follows later. Only the literature related to the aspects of mercerization which are relevant to the discussion of studio applications of cloqué is reviewed in detail.

History of Mercerization

In 1844, John Mercer, an English calico printer, discovered that cotton fabric shrank and became more dense when it was immersed in a sodium hydroxide solution. He also discovered that the cotton fabric became stiff, translucent (Walton, 1936), and stronger during immersion in NaOH. Cotton fibres which had undergone what was to become known as mercerization were more rounded, had a smaller central cavity, and had a greater affinity for dye, which meant that their dyeability increased.

In 1850, Mercer filed a patient for his process but he was not successful in developing mercerization as a commercial process. This was due to the high cost of NaOH and the shrinkage of the cloth (Walton, 1936), which meant that the cost of the resulting fabric would have been prohibitive. In 1884, Depoully in France improved Mercer's cloqué process by creating a permanent crimp (crêpon) effect which could be used on wool, silk, or cotton. This process began to be used commercially in France in 1890-91 (Walton). Success with commercial applications of cloqué in England began in 1889-1890 when H.A. Lowe discovered a way to give fabric lustre by holding it under tension during the NaOH treatment (Walton).

Materials of Mercerization

Cotton is the fabric which is normally mercerized, but wool and silk can also be treated for crimp effects (Walton, 1936). Hall (1966) mentions that blends of cotton with acetate, viscose rayon, or cuprammonium rayon can be mercerized, but he cautions that these manufactured fibres have greater reactivity to NaOH than cotton does and may be damaged by the alkali.

Processes of Mercerization

There are two processes of mercerization: tension and slack mercerization. Walton (1936) describes two procedures for tension mercerization. In one method, cotton yarn is stretched tight, washed in sodium hydroxide (NaOH), and then washed in water while it is still stretched. This method produces yarns characterised by permanent lustre. In the second method of tension mercerization, the cotton yarn is immersed in caustic

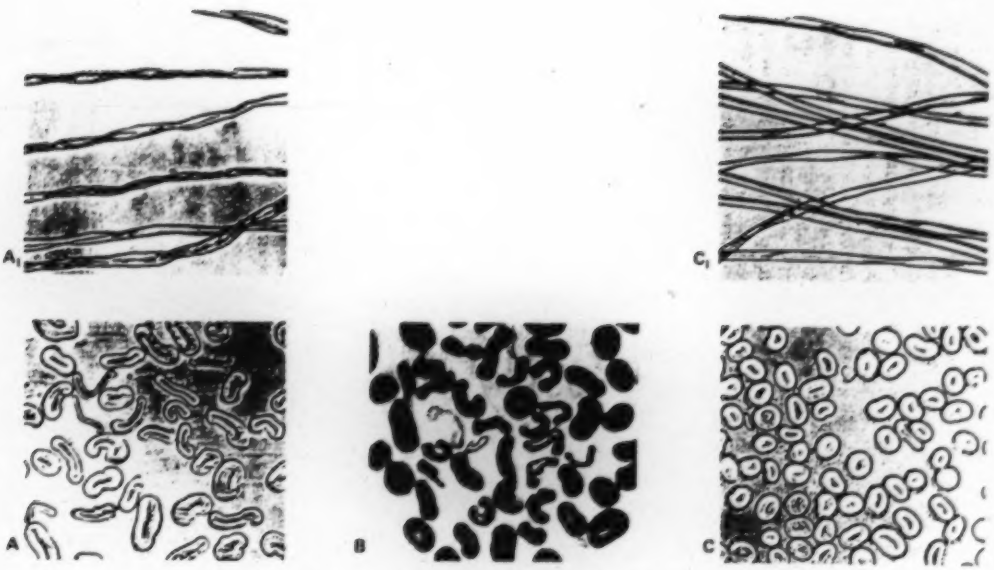
soda, removed, stretched beyond its original length, and washed in water until the tension lessens. When a piece of fabric is tension mercerized, it is stretched before the NaOH immersion, is sprayed with NaOH, then dipped into dilute sulphuric acid (H_2SO_4) to neutralise the alkali and then washed with water (Walton).

During mercerization without tension (slack mercerization), the fabric is permitted to shrink and is not stretched at any time. Hall (1966) states that for slack mercerization, a 20-30% NaOH solution should be used at room temperature, followed by washing in hot water, "souring" (neutralising) with acid, followed by washing in cold water. He also states that souring is very important, since mercerized cotton holds caustic soda well (Hall). Slack mercerization produces a 100% cotton stretch fabric.

When cotton is immersed in an NaOH solution, the fibres swell and untwist which makes them shorter in length and more lustrous if held under tension (Bendure & Pfeiffer, 1947). The strength of the fibres also increases. It has been suggested that immersion of the fibres in a 15% solution of NaOH results in the greatest swelling of the cotton fibres (Marsh; Bechter & Fiebig [cited in Lewin & Sello], 1983). However, higher concentrations (16-24%) of NaOH are used for commercial production (Hudson, Clapp, and Kness, 1993), since the maximum mercerization effect takes place only at higher concentrations (Lewin & Sello, 1983). (See Fig. 2). Lewin and Sello (1983) discuss the degree of fibre swelling (at 20°C) in relation to various concentrations of NaOH. As the concentration of NaOH increases, swelling increases, then decreases, and then slowly increases again (Bartunek [cited in Lewin & Sello]). (See Fig. 3). Most changes in the cotton fibres take place within one minute, and, generally, all changes occur within three minutes (Hall, 1966).

The lower the temperature of the NaOH bath, the greater the swelling of the fibres (D'Ans & Jaeger [cited in Lewin & Sello]). Hall (1966) suggested that the efficiency of mercerization is reduced if the temperature of the NaOH bath is higher than about 30°C and that it is better if the NaOH bath is cooler than 20°C. Olson (1983) supports this and states that with a 20-30% NaOH solution, there is not much difference in shrinkage, whether the temperature is 2°C or 18°C. If the temperature is below 0°C, the cotton fibres can swell a great deal, and less NaOH is needed, but since these processes do not increase lustre, it is not used in industry (Hall). Olson (1983) notes that another reason for using temperatures around 20°C is that mercerization at a higher temperature results in fabric with more desirable qualities such as higher tensile strength.

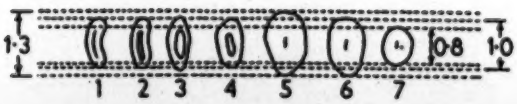
There are other chemical effects of mercerization. Hall (1966) reports that mercerized cotton is 1½ times as reactive chemically as unmercerized cotton. This means mercerized cotton has a higher moisture absorption and a greater affinity for the dye. The increased affinity for water and chemicals is due to the cotton cellulose being permanently swollen by the NaOH. This swelling creates more space between the molecules to accommodate dyes and chemicals. Another chemical effect is alkali cellulose auto-oxidation. (Davidson [cited in Lewin & Sello, 1983]). This is the degradation of cellulose fibre which occurs if there is oxygen present in the hot NaOH (Davidson).



Longitudinal photographs of unmercerized and mercerized cotton fibers (A_1 and C_1); cross-section of unmercerized, partially mercerized and fully mercerized fibers (A, B and C).

Figure 2: Mercerized and unmercerized cotton fibres

From Textile Wet Processes (p. 161) by E. S. Olson, 1983, Park Ridge: Noyes Publications.



Seven successive stages of change in the cross-sectional shape of a cotton fibre as produced during mercerization. Stages 1 to 5 show the change from a twisted ribbon-like fibre to one which is uniformly cylindrical and in its most swollen form at 5. Stages 6 and 7 show some contraction but without losing its cylindrical form when the fibre is washed with water (6) and then dried (7)

Figure 3: Stages of cotton swelling in mercerization

From Textile Finishing (3rd ed.) (p.26) by A. J. Hall, 1966, London: Heywood Books.

Applications of Mercerization

The major reason to mercerise fabric under tension is to increase moisture absorbency so finishes and dyes are more readily absorbed. Other reasons to mercerise fabric are to increase the tensile strength (resistance to lengthwise stress) and smoothness of the fabric, to increase its lustre, and to increase its dimensional stability (Bendure & Pfeiffer, 1947; Hall, 1966; Lewin & Sello, 1983; Hudson, Clapp, & Kness, 1993).

The purposes of slack mercerization are to improve the elasticity of the fabric and to produce 100% cotton stretchy fabric (Lewin & Sello, 1983). According to Hall (1966), a 25-30% wider width than needed in the final fabric, with a lower thread count than desired in the final fabric, is required to produce the desired width and count after slack mercerization. Another reason to slack mercerise fabric is to produce crêpe effects more economically than by using weaving techniques.

Literature Related to Cloqué

Cloqué may be described as a crinkled fabric produced by lye crimping (or slack mercerization). The review of literature related to cloqué includes information concerning the history, materials, procedures, and applications of cloqué.

History of Cloqué

Puckered or gathered effects on fabric were originally produced through weaving techniques such as the use of slack tension warp which results in seersucker (Bendure & Pfeiffer, 1947) or by the use of highly twisted yarns which produces crêpe fabric (Hall, 1966). These crimped effects on fabric were first chemically created by Depoully in

1884 (Walton, 1936). Chemical crimping was made possible by John Mercer's discovery that NaOH caused cotton fabric to shrink and pucker.

Materials of Cloqué

The chemicals used for cloqué are similar to those used for mercerization. These are sodium hydroxide (NaOH), sulphuric acid (H_2SO_4), zinc chloride (ZnCl), or potassium hydroxide (KOH). As with mercerization, phenol (C_6H_6O) can be used on nylon (Hudson, Clapp & Kness, 1993). Of all these chemicals, sodium hydroxide is most commonly used. When NaOH is used, the fabric is neutralised in dilute sulphuric acid or acetic acid (CH_3COOH). Fabrics which may be used for cloqué are cotton, wool, silk (Watson, 1936), as well as some cotton/acetate or cotton/rayon blends (Hall, 1966). Nylon is also sometimes used (Hudson, Clapp & Kness, 1993). In addition, Danielson (1995) and Boutrup & Pollen (1994) have used both loosely-woven cottons and linens.

Processes for Cloqué

There are two processes for producing cloqué fabrics: industrial procedures and hand procedures. The industrial procedures for producing cloqué or plissé fabrics is almost the same as the procedure for producing slack mercerized cotton fabrics. That is, either the entire fabric is immersed in NaOH which gives an all-over crêpe effect, or an NaOH paste is printed on the fabric in stripes which results in a seersucker effect (Hudson, Clapp & Kness, 1993). NaOH can also be thickened and printed on the cloth in checks or other patterns which will cause it to crinkle or wrinkle (Bendure & Pfeifer, 1947). Another industrial procedure involves printing a pattern onto the fabric with a resist and then immersing the fabric in an NaOH bath. The resisted areas will later

pucker (Marsh, 1957). (See Plate 1). Parikh (1979) described the industrial technique used for direct NaOH printing. A roller printing machine is used which has stripes engraved on a chromium-plated roller. The print paste is 20-30% NaOH, 1.5% wetting agent, 8% gum tragacanth, which is used as a thickener. Later, the fabric is rinsed in hot water to remove the NaOH, and neutralised in an acetic acid bath before rinsing in cold water. Hudson, Clapp & Kness (1993) and Tortora (1987) state that a plissé effect which is usually created on cotton using NaOH can also be achieved on nylon, by carefully using phenol.

Bissell (1980) noted that some industrial NaOH processes such as that of applying NaOH to selected areas of the fabric or printing the fabric with resist and immersing it in NaOH could be used in the studio. There are essentially four methods that designers can use to achieve a bubbled surface on fabric using cloqué processes. Firstly, NaOH can be applied in paste form to shrink certain areas of the fabric. Secondly, fabric can be printed with a resist and immersed in NaOH. The remaining two methods of creating cloqué effects involve using a double-weave fabric woven from a mixture of cellulose and protein or synthetic yarns, or fastening a shrinkable fabric to an unshrinkable fabric. Bissell stated that NaOH can be used, together with other techniques such as screen printing and direct painting, to create interesting results. (See Plates 2-5). Textile designers, including Boutrup and Pollen (1994) and Danielson (1995), have explored a variety of processes for producing cloqué fabric with NaOH. All of these authors use the same basic industrial process in which the fabric is immersed in NaOH, rinsed, neutralised with acetic acid, and rinsed in water again. However, industrial processes often use stronger acids for neutralising the cloth (Walton, 1936).

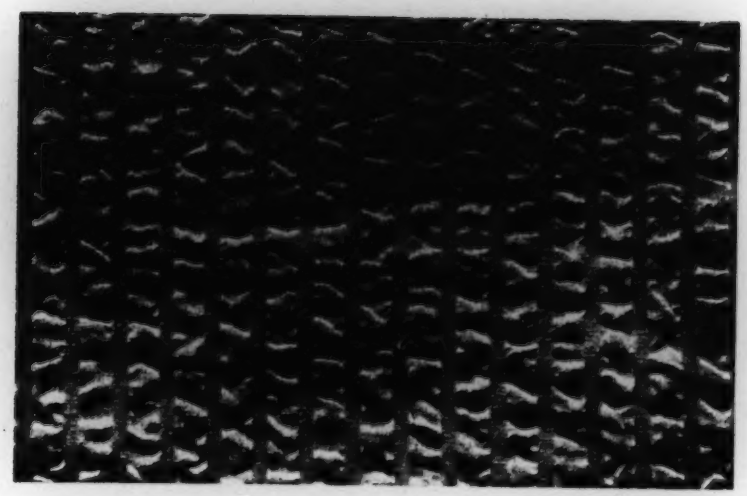


Plate 1: Striped plissé fabric

From Understanding Textiles (3rd ed.) (p.385) by P. G. Tortora, 1987, New York: MacMillan.

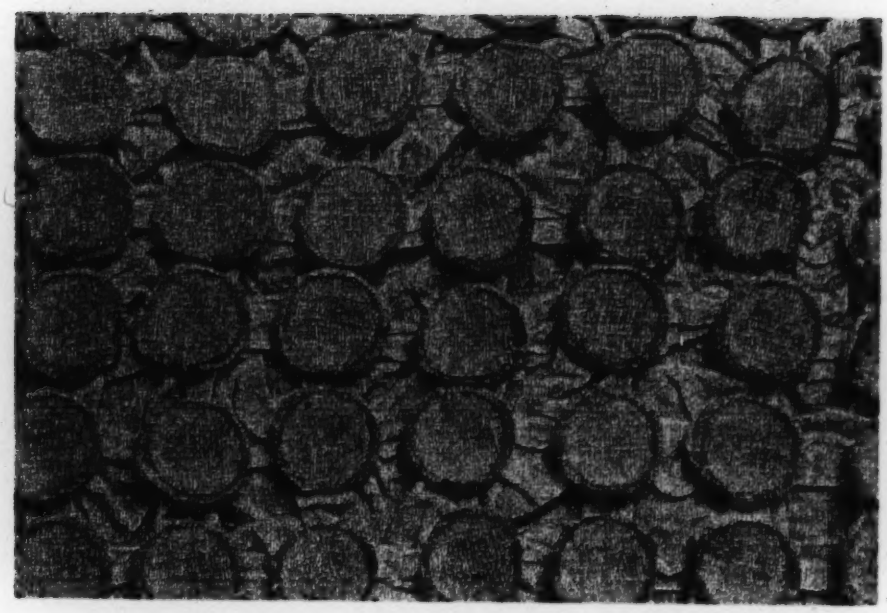


Plate 2: Detail of COPPER TRACES. Cotton fabric was molded around pennies and treated with caustic soda, which oxidized the copper and left blue-green accents around each disk.

From: "An Exploration of Caustic Soda" by J. M. Bissell,
1980, Fiberarts, pp. 44-45.
(used with permission)

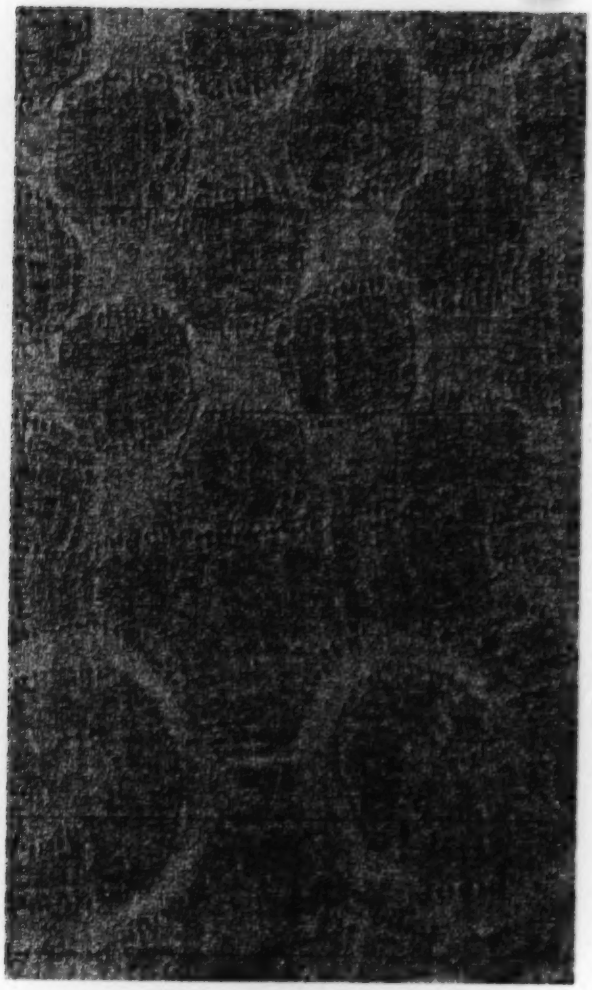


Plate 3: Detail of MINOAN CASEMENT. Caustic soda was applied to a machine-stitched checkerboard and spiral design, creating opaque areas in the cotton gauze.

From: "An Exploration of Caustic Soda" by J. M. Bissell,
1980, Fiberarts, pp. 44-45.
(used with permission)

Plate 4: June Bissell wearing her VALENTINE COAT, an example of 3-dimensional surface treatment possible with caustic soda. Photo, Michael Felder.

From: "An Exploration of Caustic Soda" by J. M. Bissell,
1980, Fiberarts, pp. 44-45.
(used with permission)

Plate 5: TENSION GAME, 96 by 44 inches. The gray areas, stiffened with polymer gloss medium, rippled when caustic soda was applied to shrink the surrounding areas.

From: "An Exploration of Caustic Soda" by J. M. Bissell,
1980, Fiberarts, pp. 44-45.
(used with permission)

Bissell (1980) pointed out a number of cautions for using NaOH in a studio setting because of its corrosive nature. She emphasised that NaOH is a "very hazardous substance" (Bissell, p.45). Bissell suggests that textile designers should not use NaOH unless they are very cautious. Another problem she found was that using NaOH on fabric can produce inconsistencies such that results obtained on a six-inch sample might not be the same on a larger piece of fabric. Boutrup & Pollen (1994) and Danielson (1995) also caution artists to wear adequate protective clothing and face protection when working with NaOH.

Applications of Cloqué

Cloqué fabrics are primarily produced for the mass textile and garment market. In 1982, A. Steiger of Heberlein Textildruck filed a patent in the U.S. and Great Britain called "Process for producing cloqué or undulating effects on the surfaces of textile fabrics." This patent implies that there was enough demand in 1982 for cloqué fabrics to make it worthwhile for a patent to be sought to produce them.

In the studio production of fabric effects, designers and artists have used cloqué techniques in a variety of ways and often in combination with other techniques. Bissell (1980) experimented with producing puffed fabrics, opaque and transparent fabrics, puffed and stuffed fabrics, and fabrics moulded around pennies (See Plates 2-5). Danielson (1995) experimented with the use of cotton and linen, the use of permanent and non-permanent resists, and the use of stitch resists comprised of different types of thread.

Boutrup and Pollen (1994) created art textiles by using NaOH in combination with binders and glue, gum resists and dischargeable dyed cotton or linen fabrics. They also experimented with sewing or gluing shrinking and non-shrinking fabric combinations, and then treating them with NaOH. Boutrup and Pollen have offered courses in these techniques to textile artists at Penland School of Crafts in North Carolina (Johnson, 1995). (See Plate 6). They have also produced a collection of instructional videos, one of which is entitled "New Tools - Cloqué - Tape 4", which was recorded at a workshop on the cloqué offered during the Surface Design Association Conference in 1994 (Boutrup & Pollen, 1995). In the cloqué video, Boutrup demonstrates how various cloqué techniques can be effected (Boutrup & Pollen, 1995). Boutrup & Pollen (Johnson, 1995) claim that although the cloqué process has been used industrially it is not well known to textile designers. Held (1995), however, states that the cloqué process, although not widely used by fibre artists, is known. Held also points out that in the late 1970's, Bissell explored caustic soda effects on cotton.

Perhaps as a result of Boutrup & Pollen's efforts to popularise cloqué techniques, artists specialising in other techniques such as shibori have begun to experiment with cloqué as well. Stabb (1997) discusses the work of Ana Lisa Hedstrom who is a textile designer who produces fabrics using arashi shibori. She has also experimented with devoré and cloqué processes in the creation of textiles. (See Plate 7). Lewis (1997) describes the work of two Danish artists, Thea Bjerg and Mette Viereck. Bjerg and Viereck were students of Joy Boutrup who is a technical advisor at the Danish Design School in Copenhagen. Bjerg worked with laminated and cloquéd silk with cotton backing and developed fabric for apparel. (See Plates 8 and 9). Viereck created sculptural

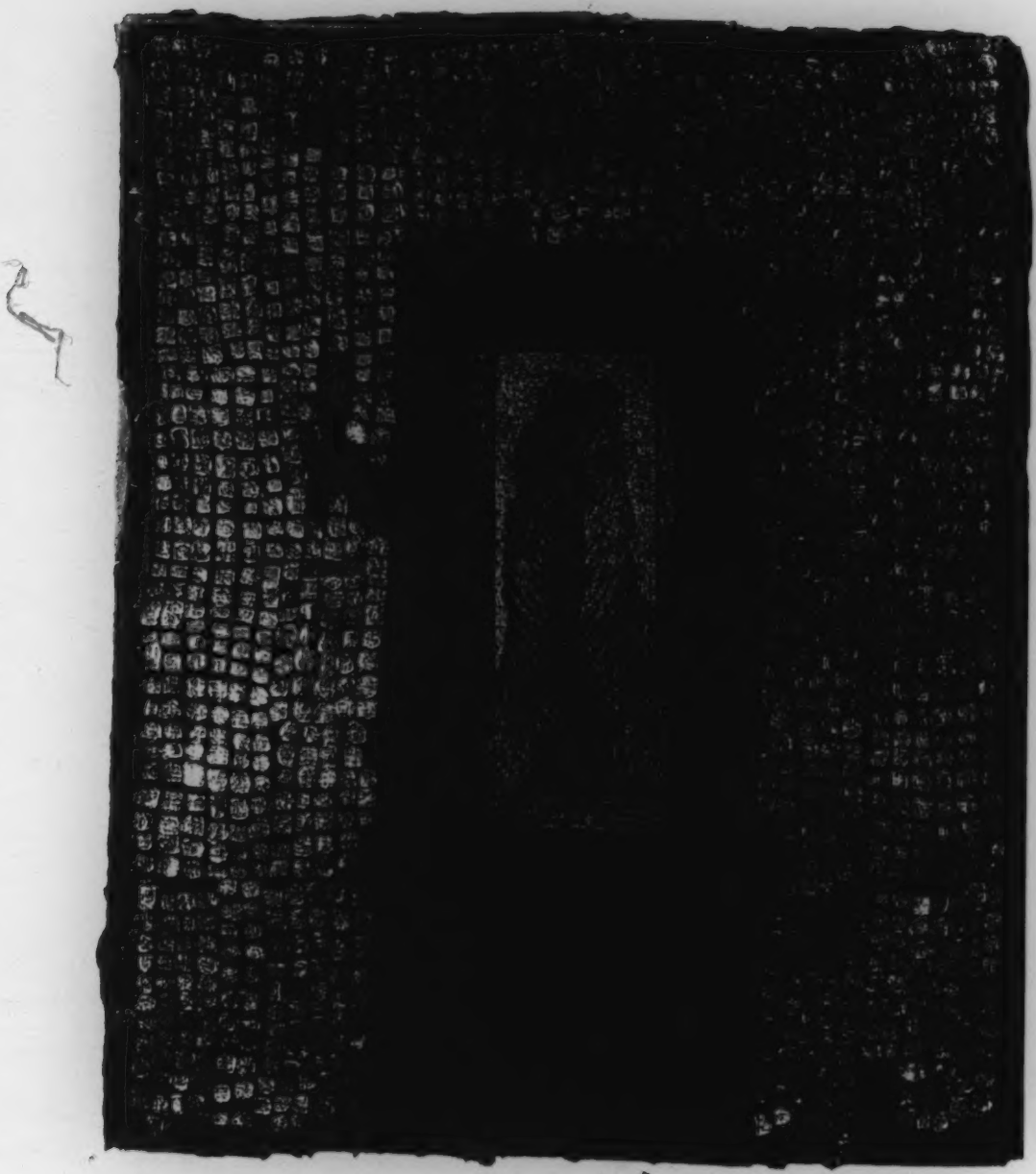


Plate 6: FORGIVENESS by Susan Lordi Marker, 1994 (liturgical commission); top layer is cotton printed with pigment, then put in a lye bath so cotton shrinks and squares "pop out", gold leaf added; second layer has cotton covered with starch paste resist that crackled when dried; when lye is applied and resist removed, the cracks are left. Gauze stitched on top.
From: "Surface Design Breakthrough" by G. Johnson, 1995, Fiberarts, p.37. (used with permission)

Plate 7: Devoré and cloqué fabrics by Ana Lisa Hedstrom

From: "East to West" by J. C. Stabb, 1997,
Surface Design Journal, p.10.
(used with permission)

Plate 8: Dyed silk satin, cotton backing, silkscreen, colour pigment, crêpe treatment, 500 cm x 70 cm, 1994, by Thea Bjerg.

From: "Denmark's Timeless Traditions" by L. Lewis, 1997, Surface Design Journal, p.14.
(used with permission)

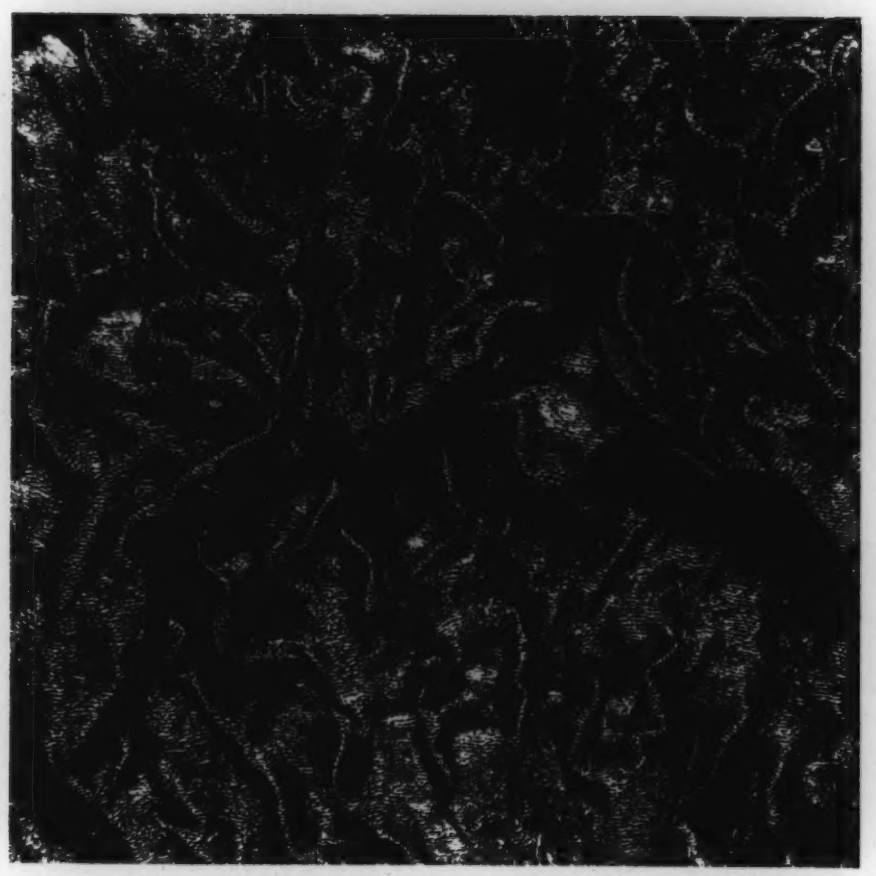


Plate 9: Silk satin, satin white cotton backing, silkscreen, crêpe treatment, 35 cm x 45 cm, 1994, by Thea Bjerg.

From: "Denmark's Timeless Traditions" by L. Lewis, 1997, Surface Design Journal, p.16.
(used with permission)

forms from undyed, hand-woven fabric which was treated using resist and the cloqué technique. (See Plate 10).

Summary

The literature review showed that there is little published research which focuses on the cloqué technique. Furthermore, only a few artists have used cloqué alone, or in combination with other processes, in order to create works of textile art. Furthermore, not many of these designers have published descriptions of the procedures they followed. It is to be hoped that this investigation will contribute to the literature in the fields of textile design and of human ecology in which cloqué studies are so sparse.

Plate 10: Untitled sculpture, hand-woven fabric, lye crimping, by Mette Viereck.

From: "Denmark's Timeless Traditions" by L. Lewis, 1997,
Surface Design Journal, p.17.
(used with permission)

CHAPTER 3

The Designing Process

Statement of the Problem

The problem which I explored in this study was the manner in which cloqué techniques can be used as tools in the production of a collection of works of textile art. Since few textile designers document or publish their studio procedures, this thesis will be of use in formalising cloqué methodology for other artists and designers. In addition, the documentation of my textile investigations as described in Chapters 4 and 5 will enable readers to understand my creative process. As with Bakgaard (1995), I hope that documenting my procedures in the production of cloqué textiles will "enhance [the artist's] understanding of the creative designing process" (p.34), helping the artist to become a better designer. This idea is supported by Zeisel (1981), who stated that "describing the design process may help designers ... understand their own behaviour and thereby improve their design ability" (p.5).

Purpose and Objectives

The purpose of this study was to examine the textile finishing technique known as cloqué and to determine its potential as a tool for fibre artists who are creating new effects in hand-printed and hand-dyed textiles. This examination was carried out by investigating cloqué processes and fibre-reactive H-series dyes in order to develop a collection of contemporary textiles. Specifically, the objectives of this study were:

1. To explore and develop expertise in various cloqué techniques;
2. To experiment with various types of fabrics and threads;
3. To develop a bank of computer-manipulated images that could be used for design inspiration; and
4. To create a collection of cloqué textiles.

Significance of the study

The literature review showed that, in general, there is little information about cloqué or documentation of studio explorations using the cloqué technique. Further, no such studies exist in the human ecology literature. Very little use has been made of the cloqué technique in the production of textile art. Furthermore, there are no studies which focus on nature-inspired, silk and cheesecloth cloqué works of textile design. There is also a need to document design procedures and outcomes, as artists have not been vigorous in documenting their work. The present study will help to fill this gap and will make a contribution to human ecology research.

Limitations and Delimitation

There are three limitations of this study. The first limitation is related to my production techniques which were limited to the textiles I could produce in my studio. Sodium hydroxide must be handled with care. For this reason, the fabric size was limited to 91 cm x 91 cm. The second limitation of this study was related to sources. The sources for studies using cloqué are extremely limited. In the past, cloqué was primarily an industrial technique and is only beginning to be utilised by artists. Furthermore, of the artists who have used the cloqué technique, only a few have published reports of the

procedures they followed. The third limitation of this study is related to my personal skills and technical abilities. Furthermore, due to the subjective nature of the design process, I was limited by my own perceptions and insights.

Delimitations are the limits or boundaries of this study. In this study, four delimitations were identified. The first delimitation is that the cloqué technique was used with fabric layers consisting of a protein fibre, a cellulose fibre, and a synthetic fibre (silk, cotton, and polyester fabrics) stitched together. The second delimitation is that only Procion H-series fibre-reactive dyes were used, rather than acid dyes or others. The third delimitation is that only computer-manipulated photographs of skies and trees were used for design inspiration. The fourth delimitation is that all works which I produced were art works meant to be hung on a wall as opposed to textiles for apparel or household furnishings.

CHAPTER 4

Preliminary Design Studies

Imagery

Studies related to the creation of contemporary textiles exist in which the designers found sources of inspiration in cross-cultural textiles. Examples of recent investigations such as these are "Sub-Saharan African Textiles" (Maguire, 1995); "Japanese Indigo-dyed Shibori" (Weir, 1994) and "Textiles of the Miao People of China" (Cao, 1994). Furthermore, Bevlin (1984), states that natural objects from the near environment can also be used as sources of inspiration.

The inspiration for the cloqué art textiles which were produced in this study was found in prairie landscapes. Alberta vistas consist of large expanses of colour such as blue skies, green forests and orange sunsets. The surface texture of cloqué is suitable for producing large expanses of colour and texture. Using a 35 mm Canon camera, I searched the Edmonton area landscape for imagery which I thought would lend itself to interpretation in cloqué. (See Plates 11 and 12).

Plate 11. View of the evening sky, Edmonton, Alberta; October, 1999.

Plate 12. View of trees, Edmonton, Alberta; September, 1999.

Computer - Aided Designing Using Adobe® Photoshop® 5.5

I selected nature photographs that most appealed to me in terms of the colour, shapes of the images, general feeling or impression, and the ability to remind me of the appearance of the original scene. Next, the selected photographs were scanned into the computer using a Hewlett Packard ScanJet IIcx scanner. The stored photographic images were then manipulated using Adobe® Photoshop® 5.5.

Adobe® Photoshop® 5.5 permits images to be modified in a number of ways such as colour modifications, format alterations and special effects. An image can be made to look as though it is a watercolour or a sketch. Images can also be distorted and stretched or rotated which means the images appear as mosaics or swirled patterns. Other options for image manipulation include cropping, dodging, burning, and blurring selected areas. My interest was in blurring the images and changing the colour.

Dyes and Fabrics

Dyes may be classified according to structure, method of application, and fibre to be dyed. Some dyes are suitable for dyeing cellulose fibres such as cotton or linen. Some dyes are suitable for dyeing protein fibres such as silk or wool and some dyes are suitable for dyeing either type of fibre. Other classes of dyes are suitable for dyeing synthetic fabrics such as polyester and nylon acetate.

I chose to use Procion H-series fibre reactive dyes, which produce good colour yields on silk. Brilliant Yellow - H8GN, Fuchsia - H8B, and Turquoise – HA comprised the additive colour palette. For the preliminary samples, 12 momme habutai silk was obtained from Opulence Silks and Dyes in Deep Cove, British Columbia. For large

samples, I used 10 momme habutai silk, which I obtained from Sureway Trading Enterprises in Toronto, Ontario. I also used jacquard silk, which I obtained in Vancouver, British Columbia.

Exploration of Cloqué Processes

I began to explore cloqué processes by conducting experimental studies based on the information provided by Boutrup & Pollen (1994). The information which these authors provide includes a basic recipe for sodium hydroxide solution (See Appendix A) and descriptions for sewing or gluing together layers of silk, cheesecloth and silk.

As described in Chapter 2, there are essentially four ways to achieve a bubbled surface on fabric using cloqué processes. Firstly, NaOH can be applied in paste form to selected areas of cellulose fabric such as cotton. The areas treated with paste will shrink and become denser, leaving the untreated areas to bubble. Secondly, the fabric can be printed with a resist and then immersed in an NaOH solution. The resist areas will not shrink, and will bubble as the unprinted areas shrink. Thirdly, a cloqué effect can be created by using a double-weave fabric, which has cellulosic yarns on one face and non-shrinkable yarns such as silk or polyester on the other face. When this fabric is immersed in NaOH, one side will shrink, and cause the non-shrinkable fabric to bubble. The fourth method of creating cloqué fabrics is to fasten a layer of various types of fabric together. One fabric must be shrinkable in sodium hydroxide and the other not. These fabrics can be fastened together by sewing or by using an adhesive such as an acrylic glue. For this study, I chose to explore the creation of cloqué textiles by sewing layers of cellulosic and silk fabric together.

In Boutrup & Pollen's paper, the authors reported that one 12-oz. (340 g) can of Red Devil™ lye was used in 2 U.S. cups (473 ml) of cold water, which resulted in a 33% solution. (1 c. U.S. = 237 g)[1]. Relative to industrial uses of mercerization, Hall (1966) reports that in slack mercerization, a 20-30% NaOH solution is used at room temperature. Hudson, Clapp, and Kness (1993) state that concentrations of 16-24% NaOH are used for commercial mercerization. Considering these sources, especially Boutrup and Pollen's claim of using a 33% solution, I began with a 30% solution. For my own explorations, I mixed the solution using pure, lab-grade NaOH pellets with distilled water. Distilled water was used to avoid the possible influence of dissolved minerals or other materials which might be present in tap water.

I mixed the solution and conducted the immersion procedures in a fume hood to avoid breathing the NaOH fumes. This eliminated the need for wearing a respirator. I wore household rubber gloves to protect my hands, a cotton lab coat to protect my clothing, and closed-toe shoes to protect my feet from accidental spills or drips. All the containers and mixing or measuring equipment I used for the NaOH were plastic or glass, since NaOH can erode metal. (See Appendix B).

The speed at which NaOH shrinks fabric increases as the temperature is reduced, but Hall (1966) and Olson (1983) state that efficiency of mercerization is satisfactory at about 20° C. I chose to use the NaOH solution at room temperature (about 20° C) for practical reasons. It would have been difficult to keep the NaOH bath at a constant temperature which was lower or higher than that of room temperature. Maximum shrinkage occurred in about 1-1½ minutes.

---

[1] According to my calculations, this results in a 72% solution. Perhaps it is a misprint.

Preparation of the Cloqué Samples

The preliminary sample studies were limited to fabrics measuring 15 cm x 15 cm in sandwiched layers composed of silk and cheesecloth. I used 12 momme (m/m) habutai silk, which I judged to be of a sufficient weight for a garment or art piece. Two locally available brands of cheesecloth were used: 'Cuisine Collection' (10.8 yarns/cm count: warp - 7.6 yarns/cm; weft - 3.2 yarns/ cm), and 'Man Friday' (13.2 yarns/cm count: warp - 7.6 yarns/cm; weft - 5.6 yarns/cm).

Prior to beginning my investigation, I machine-washed the silk with laundry detergent to remove any sizing or manufacturing oils, and to pre-shrink it. After the fabric was dried and ironed, I cut it into 15cm x 15cm squares. When placing the fabric layers together, I attempted to have the warp of the cheesecloth running vertically. This was to ensure uniform results since there is more inherent shrinkage in the warp than weft direction, as warp yarns are stretched more during the weaving process. I did not pre-shrink the cheesecloth because I wanted to maximise the shrinkage when it was immersed in NaOH, and because fabric with such an open weave would be shredded and tangled during the pre-washing. For all the stitching on the samples, I used No. 50 white mercerized cotton. Some samples were machine-sewn with a stitch length of 3.6 stitches/cm. The others were hand-sewn with a running stitch of 1.2 to 1.6 stitches/cm. The stitching patterns used were wide and narrow stripes, large and small diamonds, large and small scale and plaid. (See Figures 4 and 5 and Plate 13). I used two, five, and eight layers of cheesecloth to compare the amount of shrinkage.

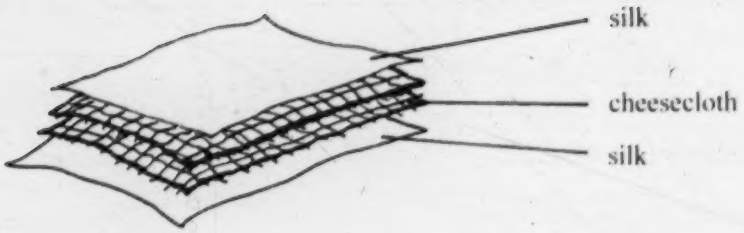


Figure 4. Construction of preliminary samples

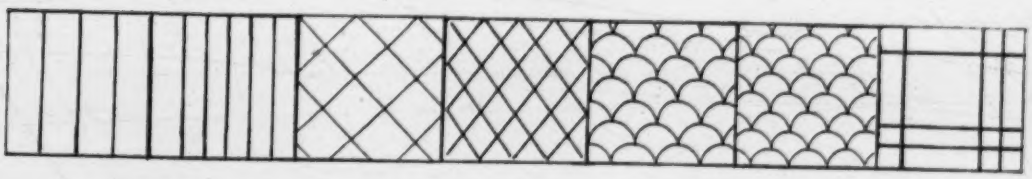


Figure 5. Stitching patterns on preliminary samples.

Plate 13. Sample, 15 cm x 15 cm, Stitched with scale pattern (left) and shrunk (right).

Boutrup and Pollen (1994) reported that they left their fabric in an NaOH solution from two to five minutes, and some for as long as ten minutes, depending upon the density of the fabric. For my samples, a 30% $^{w}/_{w}$ (by weight) NaOH solution was mixed in a three-litre glass beaker and cooled to room temperature (20° C). The solution was then poured into a four-litre plastic tub and fabric samples were immersed in the lye solution for two minutes. The samples were then wrung out and rinsed in cold running water for five minutes. Next, they were neutralised for twenty minutes in an acetic acid solution of 50 ml household vinegar (5% acetic acid) to 2 litres of water. Finally, the samples were rinsed in cold running water for five minutes and laid flat to dry.

Shrinkage of the fabric seemed to depend on the number of layers of cheesecloth I used between the outer silk surfaces. The least shrinkage occurred with two layers of cheesecloth, and the most shrinkage occurred with eight layers. The average shrinkage for each sample was 33% of its original size, but there was not much difference in shrinkage rates between the 5-layered and 8-layered samples. This may have been caused by the variables of stitching pattern size and stitch length. If the lines of stitching are close together, or a small area is enclosed by stitching lines, and eight layers of cheesecloth are used, the cheesecloth becomes a thick, dense layer. The cotton yarns are so packed together that further shrinkage is impossible. The threads may also have reached the limit of shrinkage due to the thick layers of fabric. This could be avoided, if desired, by using wider spacing of the stitching lines, and/or longer stitch lengths.

I produced two types of cloqué samples: machine-sewn and hand-sewn. The machine-sewn samples which utilised Cuisine Collection cheesecloth with a stitching pattern of wide or narrow stripes, or large diamonds, didn't shrink differently than the

samples which utilised Man Friday cheesecloth. This finding was consistent with preliminary tests that I conducted on single squares of cheesecloth in which I had found no difference in shrinkage between Cuisine Collection and Man Friday cheesecloths.

In terms of appearance, the samples sewn with wide stripes and narrow stripes stood out well. Those sewn with large diamonds and small diamonds made a successful bubbled pattern but these were difficult to tell apart from the large and small scale patterns. Perhaps this could be ameliorated by altering the proportions of each pattern or the scale of each sample. The plaid pattern showed an attractive contrast between the large unsewn space and the smaller sewn areas.

The machine-sewn patterns held the fabric layers firmly together and didn't permit movement of the silk away from the cheesecloth. As a result, more regular bubble patterns could be seen in the machine-sewn samples than in the hand-sewn pieces, especially in the small diamond and small scale patterns. Since the hand-sewn samples had been sewn with a longer stitch length and the use of running stitches instead of locked machine stitches, the silk was freer to move. The thread could also shrink more freely which produced bubble patterns with less-defined edges and more irregular folds of silk. Some samples had bubbles which flattened due to the silk sticking to the cheesecloth when it was wet. This problem might be solved by drying the samples in a cool dryer for a few minutes before air-drying them.

Results of Cloqué Samples

I found that the cloqué technique produced attractive textured effects on silk/cotton samples. The soft edges and irregular bubbles of the patterns on the hand-

sewn samples were quite handsome. However, the hand of the silk samples was harsh which may have been caused by the protein-degrading properties of the NaOH. A solution of NaOH weaker than 30% $^{w}/_{w}$ (by weight) could be tried in future samples.

Determination of Optimum Concentration of NaOH

The next step was to prepare NaOH in 30%, 22%, 15% and 10% $^{w}/_{w}$ (by weight) concentrations. I tested the specific gravity of the solutions using a hydrometer, which gives a precise measurement. The specific gravity at 20° C for the 30% NaOH was 1.250; 22% NaOH was 1.189; 15% NaOH was 1.135; and 10% NaOH was 1.097. I tested some silk and cheesecloth samples in each solution, and the 15% NaOH shrinkage was acceptable. I reduced the time the samples were immersed in the NaOH solution to 1 minute, to minimise damage to the silk. All further samples were produced using the same method: one minute immersion in NaOH; a five-minute rinse in cold running water; twenty minutes neutralising in vinegar solution (50 ml household vinegar, which is 5% acetic acid, in 2 litres water); and a final five-minute rinse in cold running water. The samples were then hung to dry.

Preparation of the Dyed Cloqué Samples

I prepared larger dyed samples measuring 91cm x 91cm to determine the effects of the cloqué shrinking on various shapes and types of patterns. The materials I used were: 10 momme (m/m) washed habutai silk from Sureway Trading Enterprises in Toronto, Ontario; 11.2 count cheesecloth, 7.6 warp fibres/cm and 3.6 weft fibres/cm; and No.60 mercerized cotton thread. Each sample measured 91 cm x 91 cm and was composed of one layer of silk and four layers of cheesecloth.

I dyed the silk using the Procion H-series fibre reactive dyes Brilliant Yellow H8GN and Turquoise HA. I chose these colours so that the lines and patterns would be clearly visible, since there is a good contrast between blue and yellow. I used four dye application techniques to apply the dye, in order to determine how various colour edges would appear after the samples were shrunk. Firstly, I used a sponge brush to apply the dye to the dry silk. This produced some merging of lines where the colours met. Secondly, I used a sponge brush to apply dye to the silk which was first wet with chemical water. This produced blurred lines where the colours met. Thirdly, I used wax resist lines which I applied with a bamboo brush. This produced crisp distinct lines of varying thicknesses. Fourthly, I used wax resist lines applied with a bamboo brush in a block pattern. This produced no blurring of the edges. The patterns in which I applied the dye contained straight, curving, and diagonal lines which were both wide and narrow, along with some dots. (See Plates 15-18). I chose this variety of patterns so that I could ascertain how visible they would be after the samples had been shrunk in the NaOH solution.

I used the steaming method suitable for H-series dye. (See Appendix D). After the fabric was steamed and washed, I ironed the fabric. I then sewed four layers of cheesecloth to the back of each piece of silk, with the warp on both vertically. I used diamond and triangle stitching patterns, and sewed them by machine at 2.4 stitches/cm. (See Plates 14,16,18,20). The space between the stitching lines was approximately 6-8 cm. I then immersed the prepared samples in a 15% $^{w}/_{w}$ (by weight) solution, which was at room temperature (20° C) in a 26-litre shallow plastic container. The samples were immersed for one minute, and then rinsed in cold running water for five minutes. They

were then neutralised in solution of 200 ml household vinegar (5% acetic acid) and 8 litres of water. Finally, the samples were rinsed for five minutes in cold running water. Later, I washed the samples in the washing machine (no detergent) to maximise shrinkage and ensure removal of the chemicals. These were then hung to dry.

Results of Dyed Cloqué Samples

The larger samples shrank more in height than width. This was because the cheesecloth shrinks more in the warp direction than in the weft direction. The diagonal stitching patterns caused some distortion of the samples. The 6-8 cm I left between stitching lines resulted in fairly dense puckering of the silk. The various shapes of the bubbles on the fabric allowed me to imagine the possible effects that could be produced by the various stitching patterns on 91 cm x 91 cm pieces of silk. The lower concentration of NaOH and the one-minute immersion time seemed to greatly reduce the harshening effect of the NaOH on silk.

Plate 14. Sample 1, dye on dry silk after stitching, 88 cm x 88 cm

Plate 15. Sample 1, after shrinking, 72 cm x 60 cm

Plate 16. Sample 2, after stitching, dye on wet silk, 88 cm x 88 cm

Plate 17. Sample 2, after shrinking, 70 cm x 62 cm

Plate 18. Sample 3, after stitching, wax resist lines, 88 cm x 88 cm

Plate 19. Sample 3, after shrinking, 72 cm x 58 cm

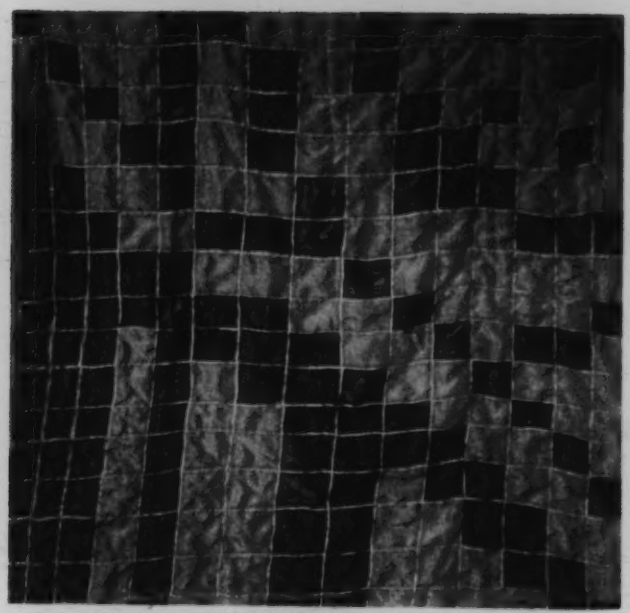


Plate 20. Sample 4, after stitching, wax resist in block pattern, 88 cm x 88 cm

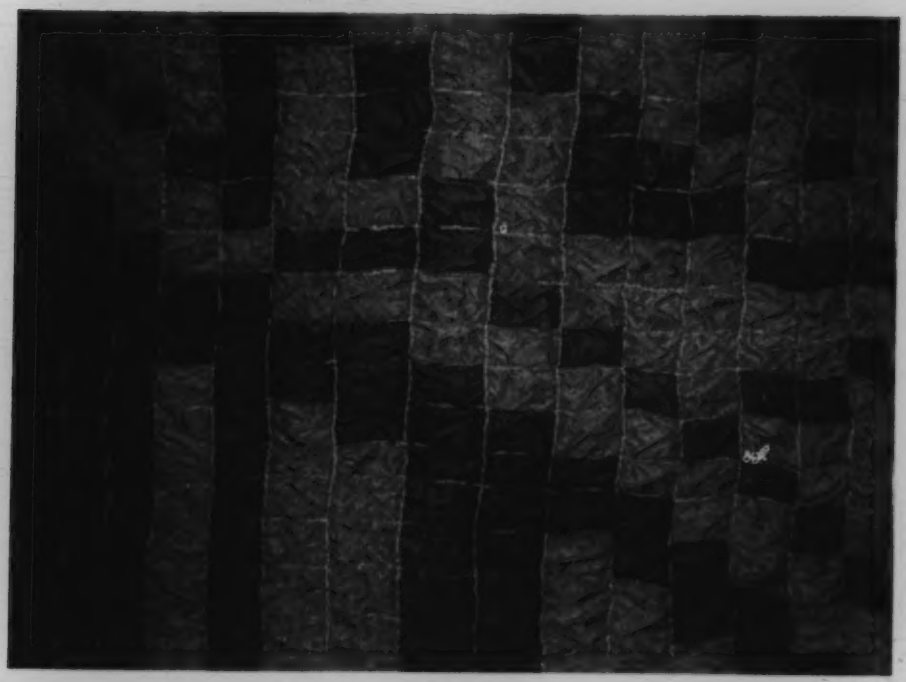


Plate 21. Sample 4, after shrinking, 77 cm x 59 cm

CHAPTER 5

Creation of the Works of Art

In this chapter, I will discuss the inspiration, materials, and procedures related to the design and creation of five large art textiles. In each of these five textiles, I began by selecting a landscape photograph that appealed to me because of its colours, shapes and/or mood. I then manipulated the photographic image on the computer, using Adobe® Photoshop® 5.5 in order to blur the image or change the colours. These manipulated images were used as inspiration for the designs applied to the silk. I painted 10 momme (m/m) habutai silk using sponge brushes and fibre-reactive H-series dyes. This was followed by steaming for 20 minutes and washing.

For each textile, I machine-sewed the silk to four layers of cheesecloth and a lightweight white polyester on the back. Polyester was chosen for reasons of economy and because polyester is unaffected by NaOH. The cheesecloth was 11.2 count (7.6 warp fibres/cm; 3.6 weft fibres/cm). I used mercerized cotton for the bobbin thread on the back of the textiles, and mercerized cotton, cotton-wrapped polyester or metallic thread for the upper thread, on the front of the textiles. The cotton-wrapped polyester thread did not shrink very much, and the metallic thread not at all. The amount of shrinkage was acceptable as long as I used the mercerized cotton on at least one side of the fabric. I utilised the same shrinking procedure as that which I used in producing the blue and yellow samples. (See page 41). The one procedural change was laying these textiles flat to dry, instead of hanging them to dry, to minimise stretching and distortion. The textiles were finished by turning under the raw edges and machine stitching.

Project 1 - Cloudy Sky

In this project I attempted to capture a slightly melancholy and introspective mood communicated by the purple and bluish-grey sky in Plate 22. I photographed the sky from my balcony one day in autumn, 1999, as I looked over the Edmonton cityscape. The photographed image was blurred using Adobe® Photoshop® 5.5 and printed on a colour printer to see the final composition. (See Plate 23). The image was then painted onto two 60 cm x 60 cm pieces of 12 momme (m/m) habutai silk which had been wet out with chemical water. Turquoise, Fuchsia and Black Procion H-series fibre-reactive dyes in were used. Painting on wet silk gave the clouds a blurred outline. I used horizontal lines of pale blue-grey and purple-grey to convey the impression of peace and tranquillity.

I machine-sewed the silk textiles to four layers of cheesecloth with lightweight polyester on the back. I sewed them using X-patterns, which produced a similar effect to the diamond pattern of stitching, but with a looser, open, more flowing feeling. This flowing feeling gave the impression of the movement of the bluish-grey clouds across the sky. The slow drifting of these clouds produced a feeling of peace and calmness, which I attempted to convey with blurred edges of colour and larger folds in the fabric. (See Plates 24-28). The finished dimensions of piece 1 were 47 cm x 46 cm; piece 2, 47 cm x 44 cm; and the finished project measured 94 cm x 46 cm.

Plate 22. View of cloudy sky, Edmonton, Alberta; October, 1999.

Plate 23. Computer-manipulated image of Plate 22.

Plate 24. Cloudy Sky, piece 1, stitched, 60 cm x 60 cm

Plate 25. Cloudy Sky, piece 1, shrunk, 47 cm x 46 cm

Plate 26. Cloudy Sky, piece 2, stitched, 60 cm x 60 cm

Plate 27. Cloudy Sky, piece 2 shrunk, 47 cm x 44 cm

Plate 28. Cloudy Sky; overall dimensions 94 cm x 46 cm

Project 2 - Bushes

This project depicts the brilliant, exuberant colours of bushes beside a path in early autumn. (See Plate 29). The multi-coloured leaves on the ground and branches created a kaleidoscope of colours, which almost gave me the impression of spinning or swirling. The muted colours of stones and ground cover contrasted with and emphasized the brightness of the leaves. Some areas were orderly, and some areas were random, wild colours.

To emphasize these impressions, the photographed image was painted using Adobe® Photoshop® 5.5, to make the image look like a mosaic. (See Plate 30). I painted the image onto two 60 cm x 60 cm pieces of 12 momme (m/m) habutai silk, using Fuchsia, Turquoise, Brilliant Yellow and Black Procion H-series fibre-reactive dyes. The first image was painted in the shape of a wheel, to emphasize the kaleidoscope impression of the colours. The image was painted on dry silk, without using resist lines, and each colour was permitted to dry before the next colour was painted. This produced interesting, jagged, dark edges where each colour met the next one. I painted a second piece of silk with the same colours used in the first piece, but made it a more abstracted image, without the wheel-shaped boundaries of the first. This was done to express the wildness of the colours.

Each textile was machine-sewn to four layers of cheesecloth with lightweight polyester on the back. A stitching pattern of large and small X's was used on both textiles to convey the feeling of variety and change. (See Plates 31-35). The finished dimensions of piece 1 were 47 cm x 46 cm; piece 2, 47 cm x 46 cm; and the finished project measured 94 cm x 46 cm.

Plate 29. View of bushes, University of Alberta campus, Edmonton, Alberta; October, 1998.

Plate 30. Computer-manipulated image of Plate 29.

Plate 31. Bushes, piece 1, stitched, 60 cm x 60 cm

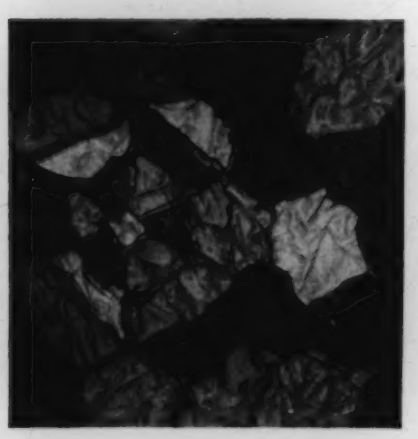


Plate 32. Bushes, piece 1, shrunk, 47 cm x 46 cm

Plate 33. Bushes, piece 2, stitched, 60 cm x 60 cm

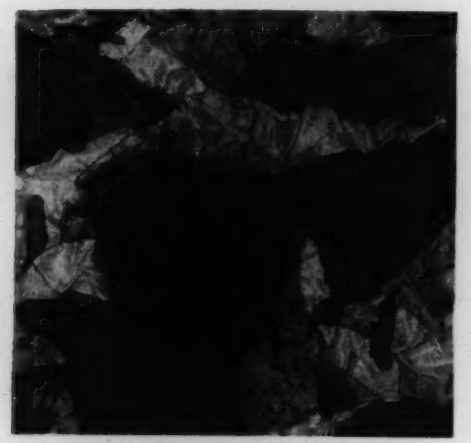


Plate 34. Bushes, piece 2, shrunk, 47 cm x 46 cm

Plate 35. Bushes; overall dimensions 94 cm x 46 cm

Project 3 - Trees

In the third project, I attempted to convey the impression of the vibrant colours and the movements of branches and leaves of trees in early autumn as seen in Plates 36 and 38. Adobe® Photoshop® 5.5 was used to manipulate the photographs so that the images looked as if they were being viewed through ripply glass. (See Plates 37 and 39). I also wanted to capture the appearance of leaves fluttering in the wind. These images were painted on two 91 cm x 91 cm squares of 10 momme (m/m) habutai silk, using Fuchsia, Brilliant Yellow, Turquoise and Black Procion H-series fibre-reactive dyes. I used clear blues, greens, yellows and oranges to express the joyful feeling experienced from viewing the coloured leaves against the blue sky. The clear colours of the dyes which were used at full intensity conveyed a feeling of lightness similar to the impression given by a light breeze swaying the branches of the low tree. This evoked a feeling of playfulness.

These two textiles were machine-sewn to four layers of cheesecloth with lightweight polyester on the back. I sewed them using a large random X-pattern of stitching so the large folds of puckered fabric would give the impression of freedom and movement. (See Plates 40-44). The finished dimensions of piece 1 were 62 cm x 72 cm; piece 2, 63 cm x 74 cm; and the finished project measured 131 cm x 68 cm.

Plate 36. View 1 of trees, University of Alberta campus, Edmonton, Alberta; October 1998.

Plate 37. Computer-manipulated image of Plate 36.

Plate 38. View 2 of trees, University of Alberta campus, Edmonton, Alberta; October, 1998.

Plate 39. Computer-manipulated image of Plate 38.

Plate 40. Trees, piece 1, stitched, 91 cm x 91 cm

Plate 41. Trees, piece 1, shrunk, 68 cm x 72 cm

Plate 42. Trees, piece 2, stitched, 91 cm x 91 cm

Plate 43. Trees, piece 2, shrunk, 63 cm x 74 cm

Plate 44. Trees; overall dimensions 131 cm x 68 cm

Project 4 - Morning Sky

The fourth project captured the beauty and calmness of the sky when it was viewed from my window at dawn in the early summer. (See Plate 45). I attempted to manipulate the colours of the photograph to show the vibrant colours I saw. Adobe® Photoshop® 5.5 was used to change the colour of the top half of the sky from blue to apricot. I then blurred the line separating the apricot and pink areas of the image. (See Plate 46). The pink and apricot colours were painted onto 91 cm x 91 cm of 10 momme (m/m) habutai silk, using Procion H-series dyes in Fuchsia and Brilliant Yellow. The use of pale pink which shaded into pale apricot was an attempt to portray the delicate beauty and freshness of the light in the sky at that time of day.

The four silk textiles were machine-sewn to four layers of cheesecloth with lightweight polyester on the back. They were stitched using a pattern of long, flowing, curved lines to convey the impression of peace and calm that, despite its tranquillity, still has an element of pleasant anticipation of the coming of the day. The stitching pattern was mostly wide and regular, which created broad folds of fabric, and contributed to the feeling of wide space, expansiveness, and peace. Small areas of closer stitching represent small surprises, such as a bird flying across the sky. I used gold metallic thread, that is barely visible, to add to the feeling of sparking anticipation of the new day. (See Plates 47-49). The finished dimensions of piece 1 were 65 cm x 70 cm; piece 2, 67 cm x 71 cm; piece 3, 69 cm x 70 cm; piece 4, 66 cm x 72 cm; and the finished project measured 263 cm x 72 cm.

Plate 45. View of a morning sky, Edmonton, Alberta; June, 1998.

Plate 46. Computer-manipulated image of Plate 45.

Plate 47. Morning Sky, piece 2, shrunk, 66 cm x 72 cm

Plate 48. Morning Sky, piece 3, shrunk, 66 cm x 70 cm

Plate 49. Morning Sky, overall dimensions 263 cm x 72 cm

Project 5 - Evening Sky

The fifth project was intended to express the awe I felt at the sight of a night sky in early summer viewed from my window as the sun was disappearing. (See Plate 50). A photograph that was taken at dusk was manipulated using Adobe® Photoshop® 5.5. The blue in the sky was intensified to approximate the deeper colours I saw later. (See Plate 51). This image was painted onto six 91 cm x 91 cm pieces of 10 momme (m/m) habutai silk, using Procion H-series dyes in Fuchsia, Brilliant Yellow, Turquoise and Black. The small streak of orange in the sky gives the impression of slowly-disappearing warmth. It is giving way to the various dark purple and blue shades of the night sky, which bring a feeling of mystery and the unknown. I hoped to express the feeling of wonder that I felt as I stared into the night sky at the stars, moon, and planets.

The six silk textiles were machine-sewn to four layers of cheesecloth with lightweight polyester on the back. The sewing pattern consisted of the outline of a large swirling galaxy, centred over sections 3 and 4. Curving, radiating lines extend outward from this centre, and extend over pieces 1 through 6. In order to show contrast among the rays, I sewed some in a square pattern, some in an X-pattern, some in stripes, and some in a diamond pattern. The closed squares and diamonds gave a tight, controlled feeling, while the X-pattern and stripes gave a looser, free feel. This provided visual contrast as well as representing the order and chaos of the universe.

Looking at the dark sky, I could see the sparkle of stars, which stimulated my curiosity. I tried to express the twinkle of the stars by sewing spots of close zigzag stitching using silver metallic thread. The small figure at the bottom of piece 1 represents a human being, who is mystified by, but part of, the vast unknown. (See Plates 52-54).

The finished dimensions of piece 1 were 66 cm x 71 cm; piece 2, 70 cm x 70 cm; piece 3, 77 cm x 75 cm; piece 4, 77 cm x 74 cm; piece 5, 78 cm x 77 cm; piece 6, 77 cm x 77 cm; and the finished project measured 4445 cm x 77 cm.

Plate 50. View of evening sky, Edmonton, Alberta; June, 1999.

Plate 51. Computer-manipulated image of Plate 50.

Plate 52. Evening Sky, piece 1, shrunk, 66 cm x 71 cm

Plate 53. Evening Sky, piece 2, shrunk, 67 cm x 72 cm

Plate 54. Evening Sky, overall dimensions 445 cm x 77 cm

Summary

The five textile art projects I completed show the progression in my technical skill as I learned how to most effectively use the cloqué processes. Projects 1, 2, and 3 have evenly-spaced stitching, which resulted in regular puckers. These provided no points of interest to catch the eye. Project 2 and Project 3 utilised various colours to provide visual interest and, therefore, were an improvement over Project 1. Project 4 was an attempt to show more contrast through the use of widely-spaced and narrowly-spaced stitching, on a surface with no dyed pattern. More areas of close stitching could have been added to improve the contrast. Project 5 used contrasting colours as a background. In stitching, some areas were left very loose and some were tightly sewn. This project provided the most visual interest regarding varied types of sewing. In Projects 4 and 5, the metallic threads were too fine to be seen from a distance. Perhaps I could improve this by using thicker metallic cord rather than thread. Regarding the finishing of the edges, it may have been better to finish the silk before shrinking it, and by also leaving 2 cm free all around the edge. The turned and sewn edges resulted in a hard and uneven edge, caused by the thickness of the shrunk cheesecloth. Another possible solution might have been to sew the backing onto each piece after it had been shrunk.

CHAPTER 6

Conclusions and New Directions

As stated by Zeisel (1981), design is not a simple activity. It can be said to consist of imaging, presenting, and testing. The imaging process involves the creation of a general mental picture of the problem to be solved. The presenting process relates to the method of expressing the mental picture so that the artist and others can visualise it. This may be achieved through sketches, models, computer-aided design tools, and other visual representations. The testing process includes the judgement or appraisal of the design, so the designer can decide whether or not the design needs modification. These three processes may be repeated over and over during the creation of a single artwork.

Zeisel (1981) also notes that the development of a design can be seen as a spiral, since it shows the backtracking necessary in improving design, and the repetition of various steps in the design process. These repetitions result in solutions to new problems that arise along the way, and this backtracking and repetition result in a gradual move forward towards the final design. (See Figure 6). Both Maguire (1995) and Bakgaard (1995) suggested that these steps in developing a design are extremely flexible and subjective, and involve the artist's use of information and inspiration. Upon reflection at the conclusion of my exploration of the cloqué process, I realised that Zeisel's spiral model of the design process accurately represents the steps I went through in designing the finished cloqué textile pieces.

Several questions arose as a result of this investigation that could lead to further areas of exploration in the use of cloqué. For the projects in this investigation inspiration was taken from the landscape and surroundings of the are in which I live. An exploration

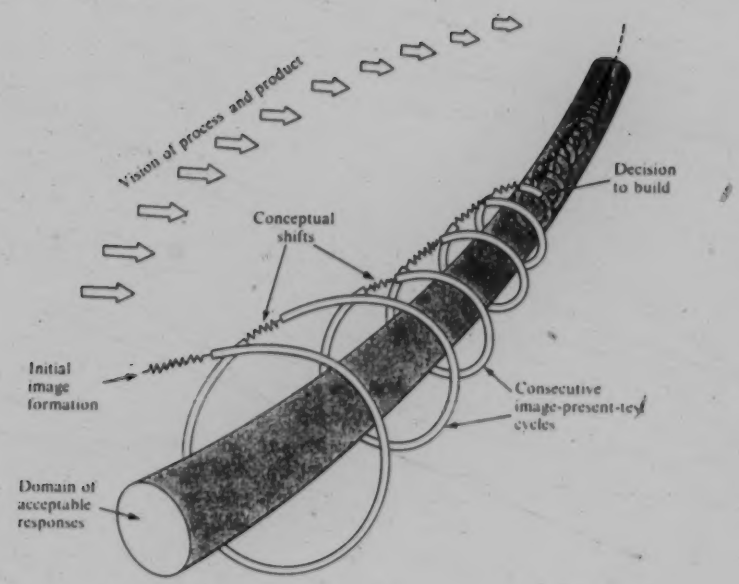


Figure 6. The design development spiral illustrating the various phases of design (Zeisel, 1984, p.14)

of other design inspirations such as cross-cultural textiles and design could produce quite varied results.

This study was limited to the use of one type of silk, habutai. Further investigation into the use of different types of silk might yield different and interesting results. Doupioni, for example, could give a very different result in terms of the texture and appearance of the final piece, depending on the weight and lustre of the doupioni used. The use of jacquard silk would provide ready-made motifs which could be enlarged and stitched to make the final design. (See Plate 55).

The cloqué technique examined in this investigation required a strong caustic solution of NaOH. Further investigation into techniques and materials less toxic would be quite valuable. Such an investigation might lead to cloqué being used in more textile artists' studios.

I offer this research as an example of how this textile artist used cloqué as a technique in creating contemporary hand-decorated textiles. Perhaps other textile artists will find this technique as interesting as I have and use it in their own textile creations and research.

Plate 55. Jacquard silk with bamboo, 88 cm x 80 cm

BIBLIOGRAPHY

Bakgaard, W. (1995). Design synectics: Machine knitwear. Unpublished master's thesis. University of Alberta, Edmonton.

Bendure, Z. & Pfeiffer, G. (1947). America's fabrics: Origin and history, manufacture, characteristics and uses. New York: Macmillan.

Bertolina, G. (1970). New developments and possibilities in burnt-out styles of printing. Melliand Textilberichte International, 51(7), 812-815. (abstract only)

Bevlin, M. E. (1984). Design through discovery. (4th ed.). New York: CBS College.

Bissell, J. M. (1980, Nov/Dec). An exploration of caustic soda. Fiberarts, pp. 43-45.

Boutrup, J. & Pollen, J. (1994). Structure changes - lye crimping. Paper presented at a workshop at the annual conference of the Surface Design Association, Portland, Oregon.

Boutrup, J. & Pollen, J. (1995). New tools -Cloqué, Tape 4 [Videotape].

Brierly, D., Connor, H. G., & Provost, J. R. (1985). Use of disperse dyes containing diester groups in the production of carbonization prints (100% burn-outs) by direct, discharge and conversion printing styles. Colourage, 32(1), 15-22.

Cao, N. (1994). The textiles of Miao women as sources of inspiration for contemporary textile design and production. Unpublished master's thesis. University of Alberta, Edmonton.

Czerny, A. R. (1988). Printing of natural silk. Melliand Textilberichte/International Textile Reports (German edition), 69(6), 438-439; E 225-E 226.

Danielson, S. (1995, August). Cloqué. Paper presented at a workshop at the annual conference of the Surface Design Association, Portland, Oregon.

Datye, K. V. & Vaidya, A. A. (1984). Chemical processing of synthetic fibers and blends. New York: John Wiley & Sons.

Hall, A. J. (1966). Textile finishing (3rd ed.). London: Heywood Books.

Harris, J. (Ed.). (1993). Textiles: 5000 Years. New York: Harry N. Abrams, Inc.

Held, S. E. (1995, Sept/Oct). Surface design breakthrough, Letter to the editor. Fiberarts, p. 4.

Hudson, P. B., Clapp, A. C., & Kness, D. (1993). Joseph's introductory textile science (6th ed.). New York: Harcourt Brace Jovanovich.

Johnson, G. (1995, March/April). Surface design breakthrough. Fiberarts, pp. 32-38.

Lewin, M. & Sello, S. B. (Eds). (1983). Handbook of fiber science and technology: Volume 1, Part A. New York: Marcel Dekker, Inc.

Lewis, L. (1997, Winter). Denmark's Timeless Traditions. Surface Design Journal, pp.12-17.

Maguire, K. (1995). Starch paste and indigo dye: Subsaharan African inspired contemporary textile designs. Unpublished master's thesis. University of Alberta, Edmonton.

Marsh, J. T. (1957). An introduction to textile finishing. London: Chapman & Hall Ltd.

Olson, E. S. (1983). Textile wet processes. Park Ridge: Noyes Publications.

Parikh, D. V. (1979). Creating fashionable fabrics with caustic mercerization. American Dyestuff Reporter, 68(8), 60-63.

Perkuhn, U. (1986). Unlimited variety of fashionable effects produced by pigment printing. Melliand Textilberichte, 67(12), 883-889. (abstract only)

Proctor, R. M. & Lew, J. F. (1995). Surface design for fabric. (Revised ed.). Seattle, WA: University of Washington Press.

Reed. M. (1989, June). Transparent look to fade? Textile Horizons, pp. 38-39.

Spring wool is "real cool" (1983, Sept). Textile Horizons, p. 54.

Stabb, J. C. (1997, Fall). From East to West. Surface Design Journal, pp. 9-12, 42.

Surface Design 78. (1978). West Lafayette, Indiana: Purdue University.

Tortora, P. G. (1987). Understanding textiles (3rd ed.). New York: Macmillan.

Walton, P. (1936). The story of textiles. New York: Tudor.

Weir, W. (1994). Indigo dyed shibori textiles: A contemporary interpretation. Unpublished master's thesis. University of Alberta, Edmonton.

Zeisel, J. (1981). Inquiry by design: Tools for environment-behavior research. Monterey, California: Brooks/ Cole.

Patents: Steiger, A. (1980). Process for producing cloqué or undulating effects of the surfaces of textile fabrics.

USP 4,215,991, Heberlein Textildruck, A. G.
Shirley Institute. (abstract only)
GB 2 015 434 A (same as above) abstract only)

APPENDIX A

Method for preparing NaOH 15% $^{w}/_{w}$ (by weight) solution (15 g pellets to 100 g water):

1. Wear protective clothing, rubber gloves, and eye protection. If using a fume hood, a respirator may not be necessary.

2. Weigh 150 g of NaOH pellets on a gram scale. Use a plastic or glass container. Work quickly, as NaOH is hydrophilic and quickly absorbs moisture from the air.

3. Slowly pour the pellets into a plastic or glass container holding 1 litre of cold water, stirring constantly. The container of water may be in another container and surrounded by ice and water. This prevents the NaOH mixture from becoming too hot as the pellets react in the water.

4. Continue stirring until pellets are dissolved. Cover with a tight-fitting lid. I waited until the NaOH reached room temperature (20° C) before using it. If leaving the NaOH for any length of time, the tight-fitting lid is important to prevent evaporation and re-crystallisation of the NaOH. The solution can be used over many times.

APPENDIX B

MSDS SAFETY DATA SHEET
PRODUCT #: S5881 NAME: SODIUM HYDROXIDE ANHYDROUS PELLETS
MATERIAL SAFETY DATA SHEET, Valid 5/1999 - 7/1999
Printed 09/14/1999 15:11

Sigma Chemical Co.
P.O. Box 14508
St. Louis, MO 63178 USA
Phone: 314-771-5765

SECTION 1. - - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -
CATALOG #: S5881
NAME: SODIUM HYDROXIDE ANHYDROUS PELLETS
SECTION 2. - - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -
CAS #: 1310-73-2
MF: HNAO
EC NO: 215-185-5
SYNONYMS
CAUSTIC SODA * HYDROXYDE DE SODIUM (FRENCH) * LEWIS-RED DEVIL LYE * NATRIUMHYDROXID (GERMAN) * NATRIUMHYDROXYDE (DUTCH) * SODA LYE * SODIO(IDROSSIDO DI) (ITALIAN) * SODIUM HYDRATE * SODIUM HYDROXIDE (ACGIH:OSHA) * SODIUM(HYDROXYDE DE) (FRENCH) * WHITE CAUSTIC *
SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -
LABEL PRECAUTIONARY STATEMENTS
CORROSIVE
CAUSES BURNS.
EXOTHERMIC IN CONTACT WITH WATER.
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
TAKE OFF IMMEDIATELY ALL CONTAMINATED CLOTHING.
WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.
SECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - -
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
ASSURE ADEQUATE FLUSHING OF THE EYES BY SEPARATING THE EYELIDS WITH FINGERS.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.
DISCARD CONTAMINATED SHOES.
SECTION 5. - - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -
EXTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE TO SURROUNDING FIRE CONDITIONS.
DO NOT USE WATER.
SPECIAL FIREFIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
EXOTHERMIC IN CONTACT WITH WATER.
UNUSUAL FIRE AND EXPLOSIONS HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
SECTION 6. - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -

---

EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - - -

REFER TO SECTION 8.

ADDITIONAL INFORMATION

CONTACT WITH ALUMINUM, TIN AND ZINC LIBERATES HYDROGEN GAS. CONTACT WITH NITROMETHANE AND OTHER SIMILAR NITRO COMPOUNDS CAUSES FORMATION OF SHOCK-SENSITIVE SALTS.
NEVER ADD WATER TO THIS MATERIAL, ALWAYS ADD THIS MATERIAL TO WATER.

SECTION 8. - - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
FACESHIELD (8-INCH MINIMUM).
DO NOT BREATHE DUST.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
KEEP TIGHTLY CLOSED.
DO NOT ALLOW CONTACT WITH WATER.
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -

APPEARANCE AND ODOR

WHITE PELLETS

PHYSICAL PROPERTIES

MELTING POINT:	318 C	
VAPOR PRESSURE:	<18MM 20 C	3MM 37 C
SPECIFIC GRAVITY:	2.130	
VAPOR DENSITY:	>1	

SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -

STABILITY

STABLE.

CONDITIONS TO AVOID

DO NOT ALLOW WATER TO ENTER CONTAINER.
HEAT OF SOLUTION IS VERY HIGH, AND WITH LIMITED AMOUNTS OF WATER, VIOLENT BOILING MAY OCCUR.

INCOMPATIBILITIES

STRONG OXIDIZING AGENTS
STRONG ACIDS
ORGANIC MATERIALS
CHLORINATED SOLVENTS
ABSORBS CO2 FROM AIR.
WATER

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

NATURE OF DECOMPOSITION PRODUCTS NOT KNOWN.

HAZARDOUS POLYMERIZATION

WILL NOT OCCUR.

SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -

ACUTE EFFECTS
MAY BE HARMFUL BY INHALATION, INGESTION, OR SKIN ABSORPTION.
CAUSES SEVERE BURNS.
MATERIAL IS EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT, EYES AND SKIN.
INHALATION MAY RESULT IN SPASM, INFLAMMATION AND EDEMA OF THE LARYNX AND BRONCHI, CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

RTECS #: WB4900000
SODIUM HYDROXIDE

IRRITATION DATA

EYE-MKY 1%/24H SEV	TXAPA9 6,701,1964
SKN-RBT 500 MG/24H SEV	28ZPAK -,7,1972
EYE-RBT 400 UG MLD	OYYAA2 26,627,1983
EYE-RBT 1% SEV	AJOPAA 29,1363,1946
EYE-RBT 50 UG/24H SEV	28ZPAK -,7,1972
EYE-RBT 1 MG/24H SEV	TXAPA9 6,701,1964
EYE-RBT 1 MG/30S RINSE SEV	TXCYAC 23,281,1982

TOXICITY DATA

IPR-MUS LD50:40 MG/KG	COREAF 257,791,1963

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -
DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -
CONTACT A LICENSED PROFESSIONAL WASTE DISPOSAL SERVICE TO DISPOSE OF THIS MATERIAL.
OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - -
CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - -
EUROPEAN INFORMATION
EC INDEX NO: 011-002-01-3
CORROSIVE
R 35
CAUSES SEVERE BURNS.
S 26
IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.
S 37/39
WEAR SUITABLE GLOVES AND EYE/FACE PROTECTION.
S 45
IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).
REVIEWS, STANDARDS, AND REGULATIONS
OEL-MAK
ACGIH TLV-CL 2 MG/M3 DTLVS* TLV/BEI,1997

PRODUCT #: S5881 NAME: SODIUM HYDROXIDE ANHYDROUS PELLETS
MATERIAL SAFETY DATA SHEET, Valid 5/1999 - 7/1999
Printed 09/14/1999 15:11

EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
FEREAC 54,7740,1989
MSHA STANDARD:AIR-CL 2 MG/M3
DTLVS* 3,233,1971
OSHA PEL (GEN INDU):8H TWA 2 MG/M3
CFRGBR 29,1910.1000,1994
OSHA PEL (CONSTRUC):8H TWA 2 MG/M3
CFRGBR 29,1926.55,1994
OSHA PEL (SHIPYARD):8H TWA 2 MG/M3
CFRGBR 29,1915.1000,1993
OSHA PEL (FED CONT):8H TWA 2 MG/M3
CFRGBR 41,50-204.50,1994
OEL-AUSTRALIA:TWA 2 MG/M3 JAN 1993
OEL-BELGIUM:STEL 2 MG/M3 JAN 1993
OEL-DENMARK:TWA 2 MG/M3 JAN 1993
OEL-FINLAND:TWA 2 MG/M3 JAN 1993
OEL-FRANCE:TWA 2 MG/M3 JAN 1993
OEL-GERMANY:TWA 2 MG/M3 JAN 1993
OEL-JAPAN:STEL 2 MG/M3 JAN 1993
OEL-THE NETHERLANDS:TWA 2 MG/M3 JAN 1993
OEL-THE PHILIPPINES:TWA 2 MG/M3 JAN 1993
OEL-SWEDEN:TWA 2 MG/M3 JAN 1993
OEL-SWITZERLAND:TWA 2 MG/M3;STEL 4 MG/M3 JAN 1993
OEL-THAILAND:TWA 2 MG/M3 JAN 1993
OEL-TURKEY:TWA 2 MG/M3 JAN 1993
OEL-UNITED KINGDOM:TWA 2 MG/M3;STEL 2 MG/M3 JAN 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
NIOSH REL TO SODIUM HYDROXIDE-AIR:CL 2 MG/M3/15M
NIOSH* DHHS #92-100,1992
NOHS 1974: HZD 69070; NIS 359; TNF 112525; NOS 192; TNE 1122583
NOES 1983: HZD X3782; NIS 167; TNF 21989; NOS 120; TNE 370582; TFE 137156
NOES 1983: HZD 69070; NIS 426; TNF 133757; NOS 246; TNE 2819743; TFE 995960
EPA GENETOX PROGRAM 1988, NEGATIVE: CELL TRANSFORM.-SA7/SHE
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1998
NIOSH ANALYTICAL METHOD, 1994: ALKALINE DUSTS, 7401

SECTION 16. - - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - - -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

COPYRIGHT 1998 SIGMA-ALDRICH CO.
LICENSE GRANTED TO MAKE UNLIMITED PAPER COPIES FOR INTERNAL USE ONLY

APPENDIX C

RECIPE FOR CHEMICAL WATER FOR SILK

(for H-series fibre-reactive dyes)

For Colours		For Black	
70 g	Urea	35 g	Urea
10 g	Ludigol	10 g	Ludigol
5 g	pure water softener	5 g	pure water softener
25 g	sodium bicarbonate	20 g	sodium carbonate

- Measure the first 3 ingredients into a litre jar.
- Add 500 ml. hot tap water.
- Stir constantly until dissolved.
- Dissolve the sodium bicarbonate in 250 ml. lukewarm water.
- Add to the mixture.
- Add cold water to make 1 litre.
- Stir well. Cool to room temperature before adding dye.

* **Note**: Chemical water for black dye has a reduced amount of urea, and uses sodium carbonate instead of sodium bicarbonate.

Depth of Shade (for 25% dye concentrate)

Deep black	- 30 ml dye to 250 ml chemical water
Very dark (colour)	- 25 ml dye to 250 ml. chemical water
Dark	- 20 ml dye to 250 ml chemical water
Medium	- 10 ml dye to 250 ml chemical water
Pale	- 5 ml dye to 250 ml chemical water

APPENDIX D

STEAMING - PROCION H-SERIES DYES

1. Let the painted silk dry for at least 24 hours.

2. Roll the silk between layers of clean newsprint, and tape the outside of the paper securely.

3. Place the rolled silk inside the pre-heated steamer, after the water has started to boil. Be careful not to let the roll touch the sides.

4. Steam for 20 minutes, if steaming 1 or 2 pieces of lightweight silk. If steaming heavier silk, or a long piece, unroll the fabric and re-roll it with fresh paper, starting from the other end of the fabric. Steam again for 20 minutes.

5. When the fabric has finished steaming, unroll it immediately and hang it up to dry for 24 hours.

6. Wash out the fabric using cold water and synthropol, a surfactant which prevents washed off dye from migrating to other areas of the fabric. Slowly increase the water temperature after each rinse water runs clear. Continue until rinsing in very hot water. I then reduce the temperature to cool water at the end to help minimise wrinkling.

7. Hang the fabric to dry.